Water Capture Device (WCD) Parabolic Flight Test

(Proposal Number will be assigned by FOP)

Technology Need

The ORBITEC Water Capture Device uses unique microgravity-specific phenomena in a novel way to create an efficient (lower mass, lower power consumption, higher reliability) means of capturing, transporting, and collecting sparse airborne liquid droplets. This technology can replace existing, less robust solutions for a variety of human spaceflight subsystem applications, such as the capture and concentration of water condensed in a typical spacecraft ECLSS condensing heat exchanger.

Technology Concept

The WCD is a passive device that transitions a sparse droplet liquid-gas flow into a naturally stable single rivulet flow under a variety of wetting conditions. Separation is achieved by rapidly changing the momentum of the mixture. Liquid retention is achieved by capillary forces assisted by air flow. Currently at TRL-6

Technology Development Team

PI: David Hoerr, Project Manager
Organization: Orbital Technologies Corporation (ORBITEC)

Test Apparatus

The test rig will contain a full-scale model of the WCD, with a system for introducing water droplets at various rates corresponding to those generated by a typical condensing heat exchanger (CHX), and a blower to provide air movement through a CHX analog. The complete test rig is 36.5”x41”x57” and weighs 291 lbs. Aircraft power is required to operate.

Water Capture Device

Flight Requirements/Objectives

The selected vehicle is the Zero Gravity Corp. Boeing 727; planned flight dates are in November 2016. Two flight days are planned to allow testing under a variety of operating conditions. Three test engineers will evaluate the ability of the WCD in microgravity to passively collect poorly-wetting condensate from a sparse-liquid/air stream, transfer the liquid via guided rivulet flow to a reservoir, and compare the results to ground testing and analyses.

Technology Advancement

Currently the WCD is at TRL-6. Drop tower tests have demonstrated basic functionality in microgravity. Initial parabolic flight test performance has confirmed agreement with analytical predictions in a relevant environment. Opportunities to reduce the size have been identified, but will lower TRL to 5. Following a second round of parabolic flight testing with the refined, reduced sized design, the WCD will again be at TRL-6 and ready for orbital flight.

Technology End Users

The WCD, as well as systems derived from it, will have a variety of applications for long-duration spacecraft and habitats. The absence of moving parts and coatings will provide increased reliability, as well as reducing power and overall mass.

Technology Area: TA6 Human Health, Life Support, and Habitation Systems